

The Rothamsted Long-term Experiments

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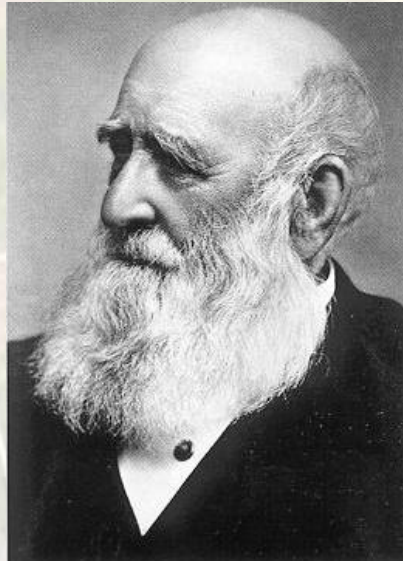


Outline

- History of the Classics & LTEs
- Sampling and analyses
- Results
- Sample and data archiving
- Collaborative work – recent/current
- Future outlook

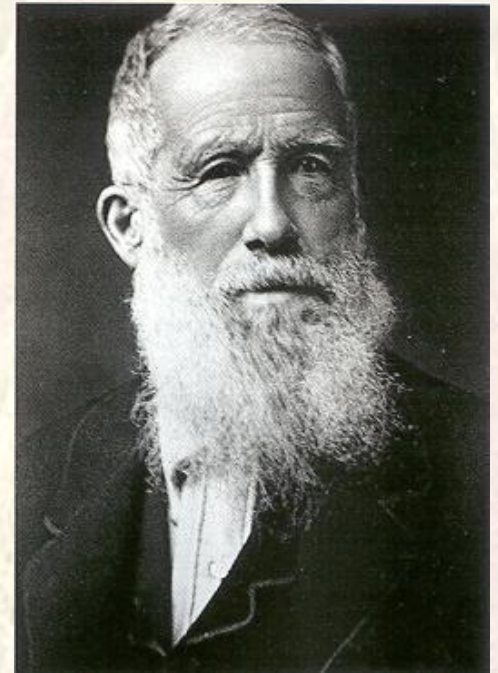


**Earliest Rothamsted
experiment started 1843**



Sir John Bennett Lawes

Sir Joseph Henry Gilbert



Broadbalk

1843 – 1926: Single plots comparing N, P, K fertilizers and organic manures.

1926: Plots split into 5 sections – to introduce fallowing for weed control

- 1968:** Plots split into 10 sections
- Crop rotations (W,W,W,O,M since 1996)
 - New shorter wheat varieties
 - Higher N rates & split N rates
 - Herbicides and fungicides



Harvesting wheat on Broadbalk 1890's

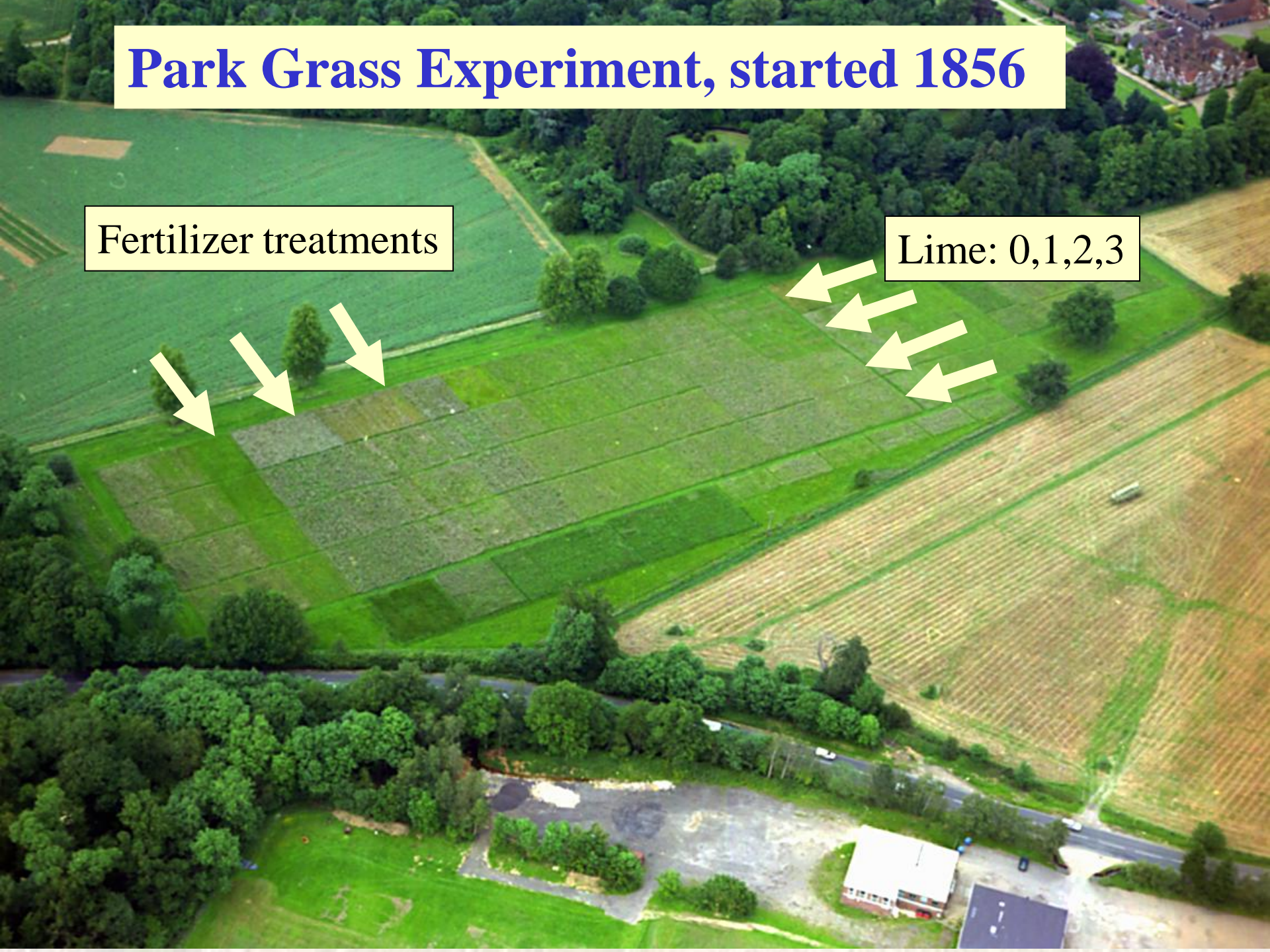


Park Grass Experiment, started 1856

Fertilizer treatments



Lime: 0,1,2,3



The Rothamsted Long-term Experiments (LTEs)

The Classical Experiments:

- **Broadbalk Wheat Experiment (1843)**
- **Park Grass Hay (1856)**
- **Hoos Barley (1852)**
- **The Exhaustion Land (1856)**
- **The Alternate Wheat and Fallow (1856)**
- **Garden Clover (1854)**
- **Broadbalk Wilderness (1882)**
- **Geescroft Wilderness (1886)**
- **Barnfield (1843) – discontinued**
- **Agdell (1848) - discontinued**

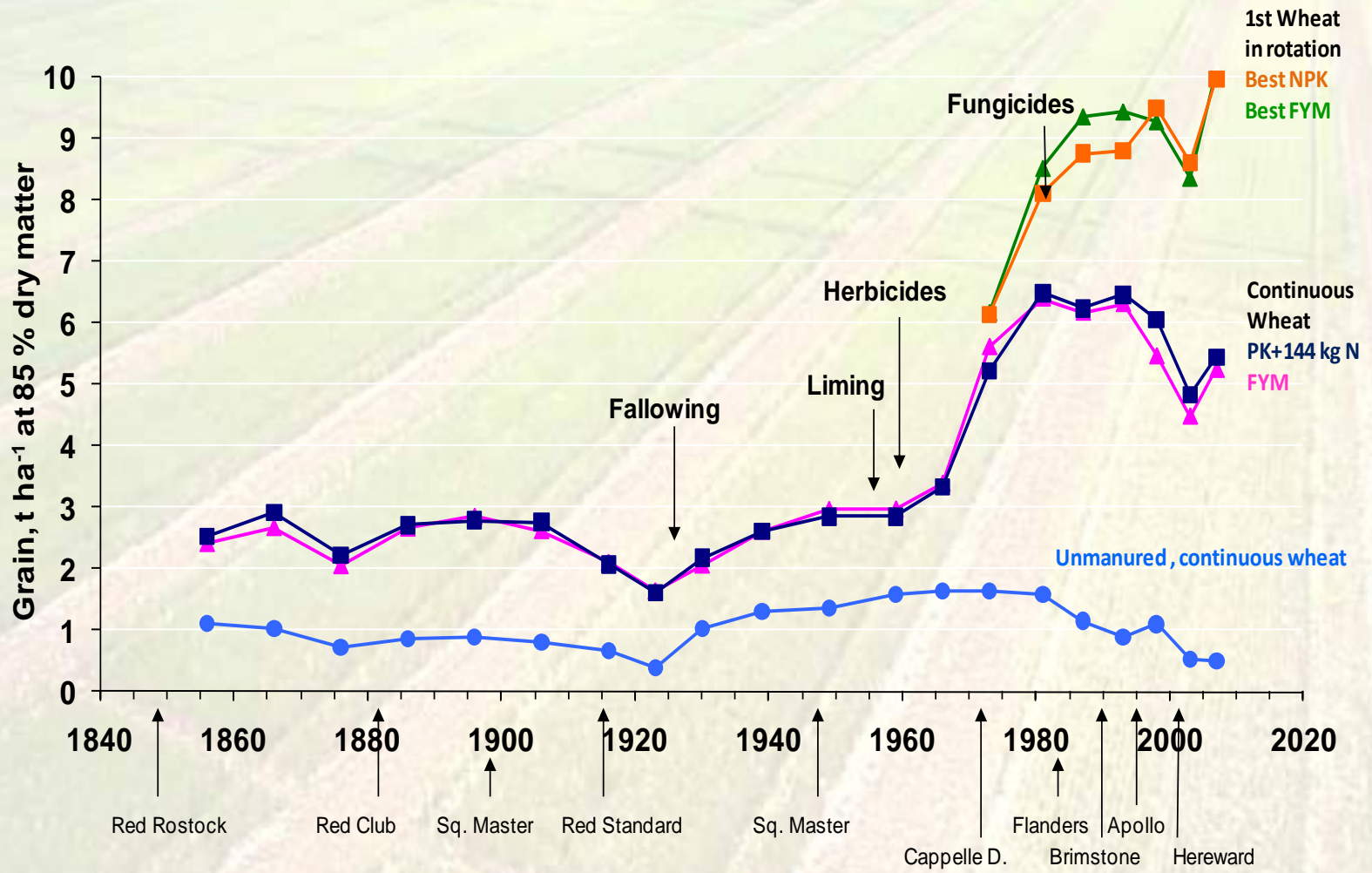
Other LTE's:

- **Highfield Ley-Arable (1948)**
- **Fosters Ley-Arable (1948)**
- **The Woburn Ley-Arable (1938)**
- **Woburn Organic Manuring (1964)**
- **Rothamsted and Woburn straw incorporation experiments (1987)**
- **Rothamsted and Woburn continuous maize experiments (1997)**

Sampling & Analyses

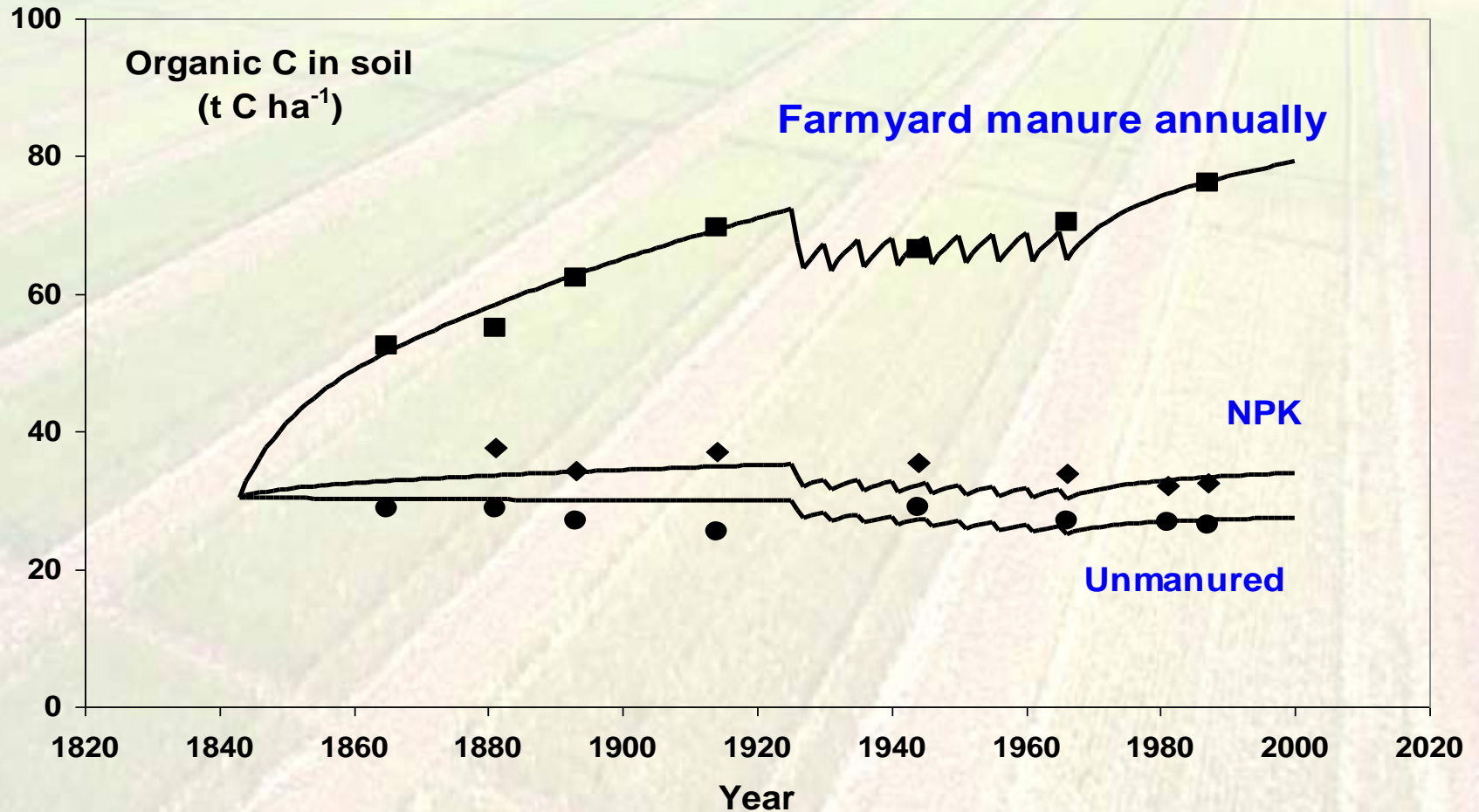
- Yield – Grain & Straw (selected plots), herbage
- Grain Quality – TGW, HLW, HFN.
- Plant analyses – Total N, Majors (P, K, Ca, Na, Mg, S), botanical surveys.
- Regular soil sampling & analyses - Total N & C, Exchangeable Cations (K, Mg, Ca, Na), Olsen P, pH, CaCO_3 .

Broadbalk Grain yields, Varieties and Changes



Broadbalk continuous wheat experiment

Data modelled by RothC-26.3 (solid lines)



Park Grass



N3PKNaMg

Nil



Nil



N*2PKNaMg

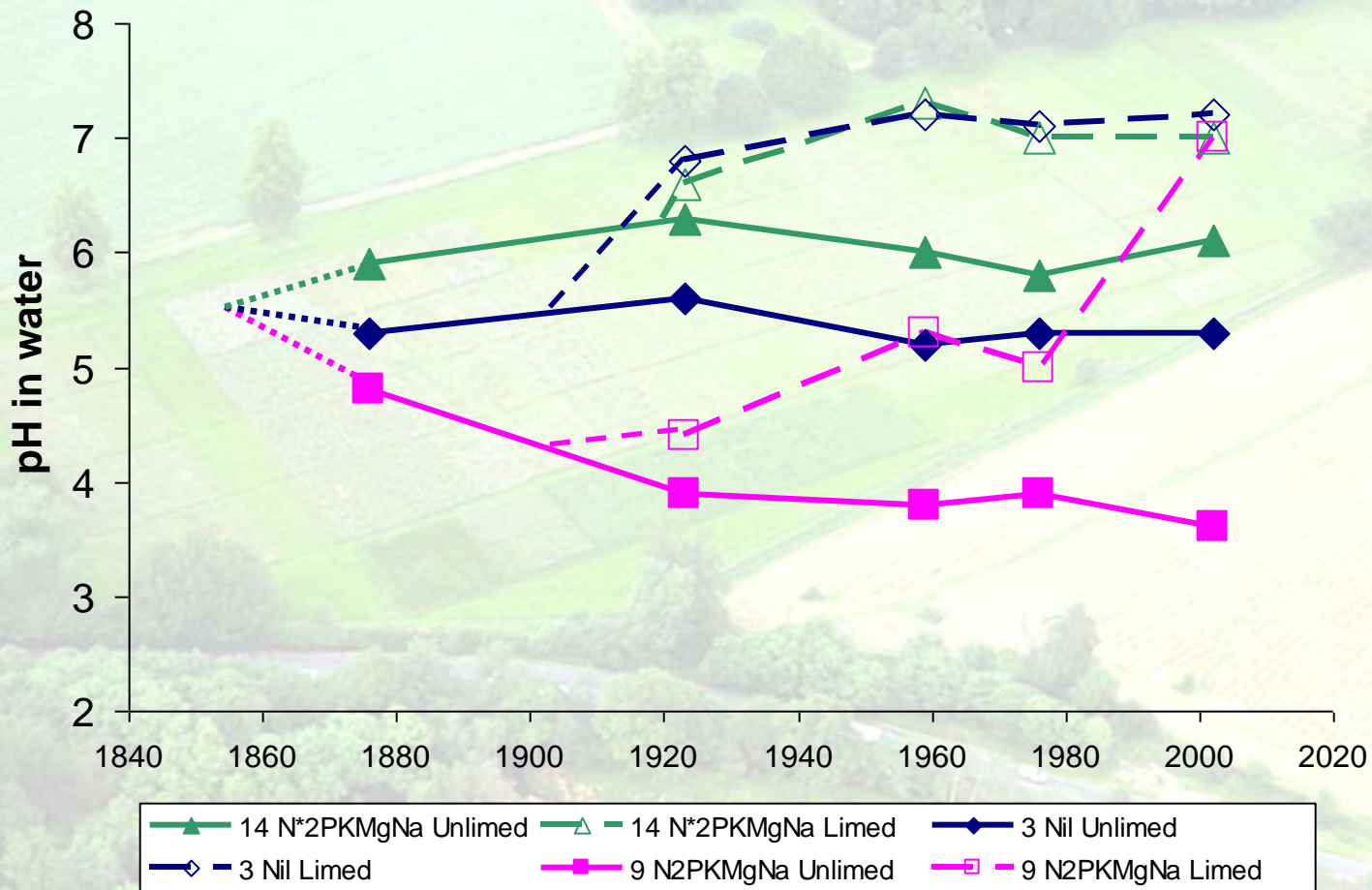
N1



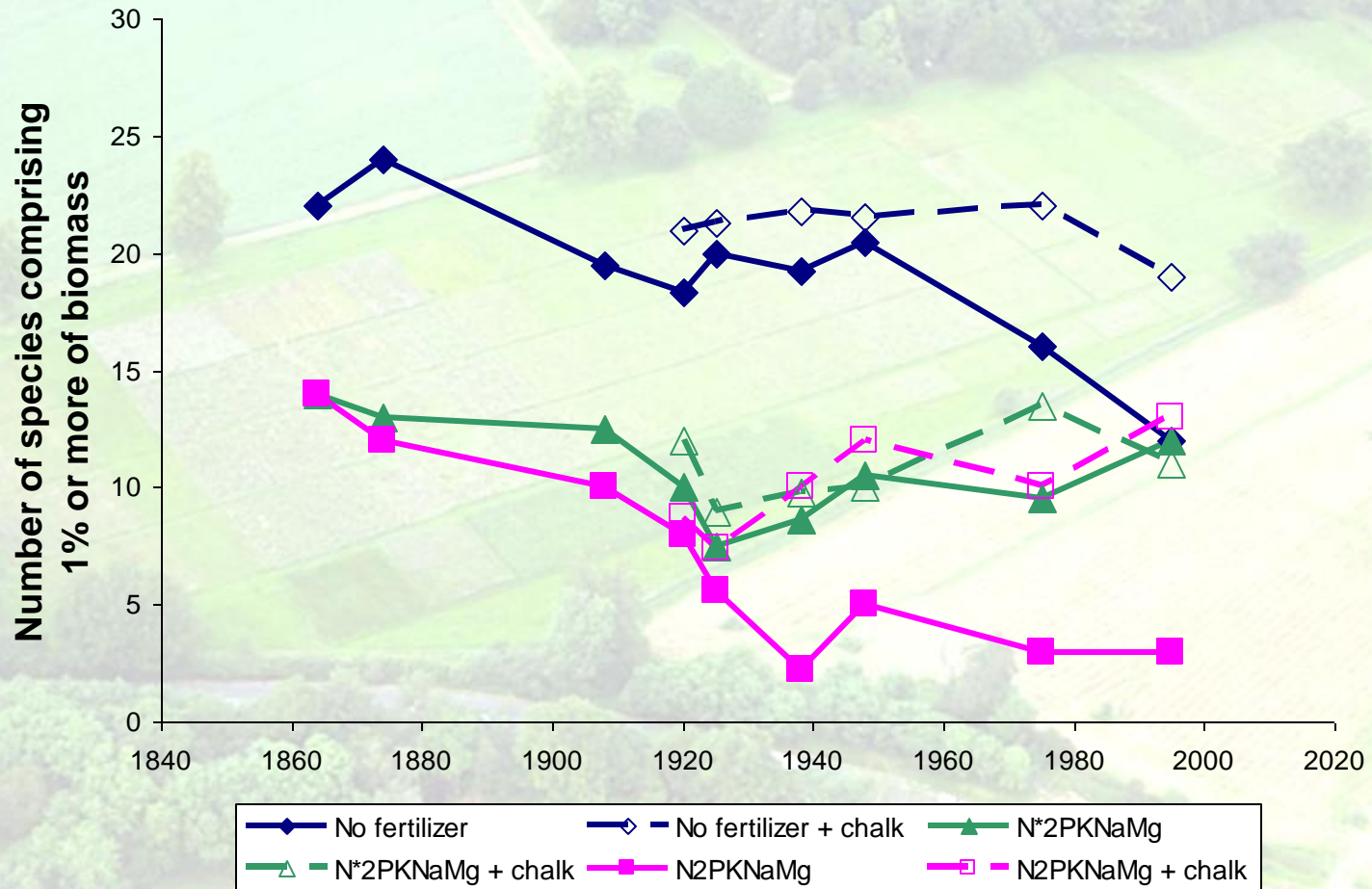
P

N2P

Changes in soil (0-23cm) pH, 1856-2002.



Park Grass: changes in species number



The New Rothamsted Sample Archive (2009)



The archive contains more than 250,000 grain, straw, herbage, soil, fertilizer and manure samples, some dating back to 1843.

The Rothamsted Electronic Archive



e-RA is managed by the BAB department – it provides access to high quality curated data for:

- Broadbalk (from 1844)
- Park Grass (from 1856)
- Hoosfield Barley (from 1852)
- Meteorological data for Rothamsted, Woburn and Brooms Barn (from 1853)
- Rothamsted Insect Survey (1960-1997)
- The Alternate Wheat and Fallow (from 1856)

It contains a comprehensive bibliography of related publications.

Recent collaborative work

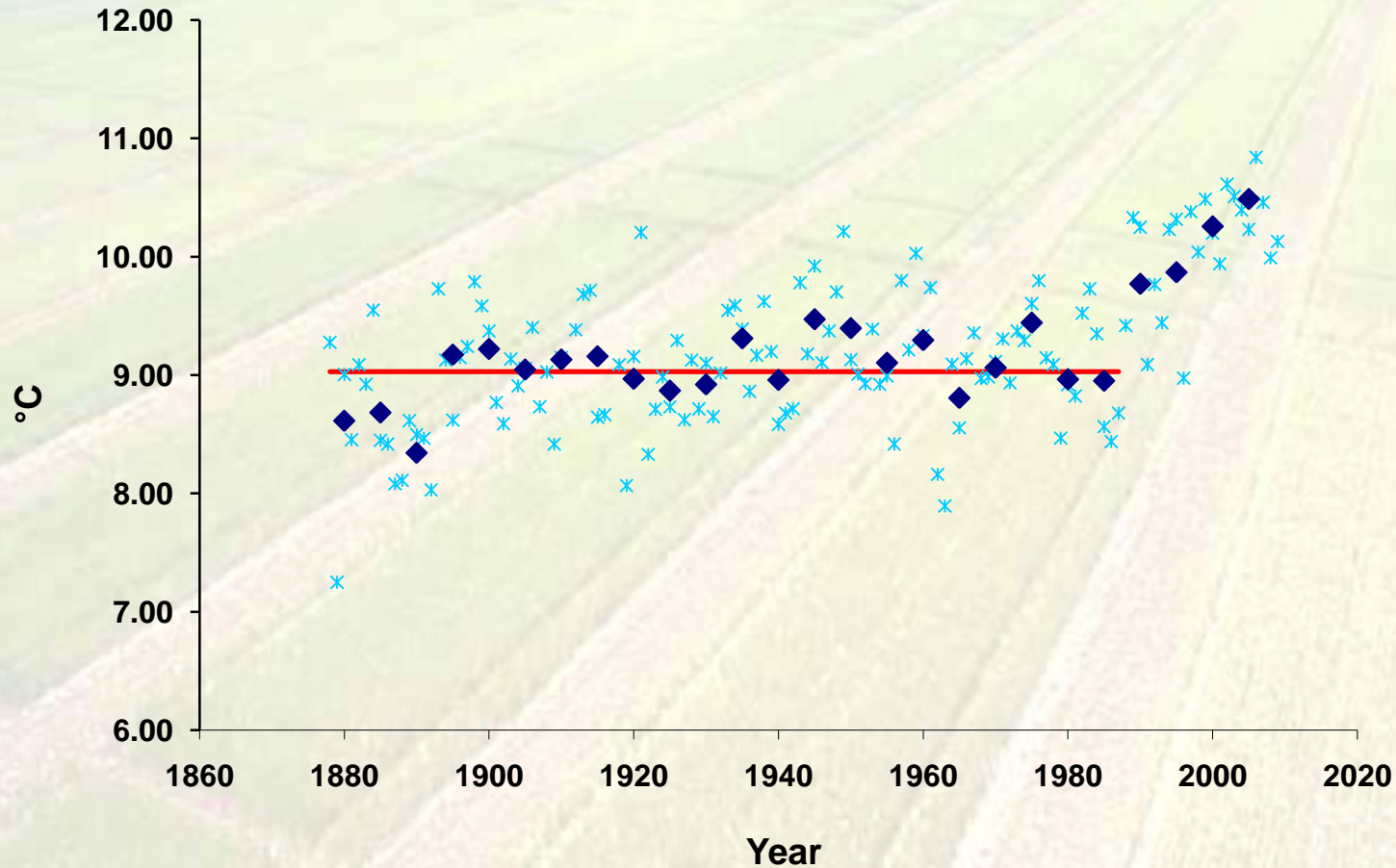
- Crop pathogen diversity and atmospheric sulphur deposition (B Fraaije + Reading University).
- Mineral (Zn, Fe, Cu & Mg) density and Se concentrations in wheat grain on Broadbalk. (F Zhao + China Ag University).
- Wheat gene expression in relation to different manuring regimes on Broadbalk (M Hawkesford + Bristol University)
- Effects of liming on soil organic matter on Park Grass (A Macdonald/P Poulton + Ulster & Lancaster Universities).

The Future - Climate Change



Rothamsted Farm 1947

Annual Mean Air Temperature 1878-2009



* Mean Temperature ◆ 5 Year Mean — Mean Temp 1878 to 1987

Conclusions

- **The full effects of global climate change on the sustainability of agro-ecosystems will take many years to become apparent.**
- **It is only by using long-term experiments that we will be able to identify these effects and, hopefully, mitigate against any adverse changes.**
- **The Rothamsted Long-term Experiments have provided extremely valuable agro-ecological information in the past and continue to do so for today's scientists.**
- **Providing they are maintained and used in conjunction with new ideas and techniques and they will continue to provide valuable information for future generations.**

Acknowledgements

- **SGS** - Chris Hall, Mariana Marczyova, Tony Scott, Paul Poulton, David Powlson, David Jenkinson, Kevin Coleman, Keith Goulding and others.
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